

IFW AFF 12811



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Yamaguchi, et al.

Serial No.: 10/087,556

Filed: 03/01/02

For: Semiconductor Device and Bump Formation Method

Docket No.: TI-31471

Examiner: Im, J. M.

Art Unit: 2811

Reply Brief

Mail Stop Appeal Brief  
Commissioner for Patents  
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Jay M. Cantor

Sir:

In response to the Examiner's Answer, an initial discussion of the problem involved and the solution is believed to be in order. As demonstrated in paragraphs [0005] to [0007] of the subject specification, there is a problem of non-uniformity of bumps fabricated by the prior art methods as described in paragraphs [0002] to [0004], this prior art being present in the patent to Kanda (6,153,938), the principal cited reference, and it is this problem of non-uniformity and the benefits derived from the subject solution to this problem which is the issue in this appeal. The bumps as shown in Kanda Fig. 3 appear at first glance to be similar to those of the subject invention. However, when reviewing the specification of Kanda, it becomes evident that the bumps are nothing more that

the result of a single operation of forming a ball, attaching the ball and then removing the capillary with the tail end of the bump remaining, this being identically the prior art described in the subject specification. The bump of Kanda is a single body. This is evidenced from the uppermost portion of Fig. 3 of Kanda where the capillary in 32 deposits the ball on the substrate 1, crushes the ball in 34, moves away from the crushed ball with a tail which is a part of the bump remaining which extends out of the capillary bore in 36, the capillary moves farther away in 38 and leaves the ball bond with tail in 40. The flattening step 50 takes place in a separate operation, but on the single solid element previously formed with ball and tail. The bump of Kanda prior to the flattening operation 50 presents identically the problems described in paragraphs [0005] to [0007] of the subject specification. The solution, if any, in Kanda is entirely different from that of the present invention and utilizes a single solid member or body.

In accordance with the subject invention, the problem of uniformity of the bumps is minimized by an entirely different procedure from that of Kanda. The bump includes on the contact pad a coaxially-aligned stack of bodies having different cross-sectional dimensions, the bodies at the top of the stack having smaller cross-sectional dimensions. It is very clear from this wording that the bump is form, not from a single body, but from plural bodies. The term "stack of bodies" has a clear meaning in the English language, that being that there are more than one body as found in Kanda. There are at least two bodies which are stacked and the body or bodies on top have a smaller cross-sectional dimension

than the body therebelow. Nothing of the type is taught or even remotely suggested by Kanda. The above-described feature is also found in independent claim 13 and 18.

**Conclusions**

In view of the above arguments and the arguments presented in the Brief on Appeal, Appellant appeals for the reversal of the rejections and allowance of Claims 1-6 and 9-22.

Respectfully submitted,



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